Ontario Geological Survey

Northern Ontario
Engineering Geology Terrain Study 38

GOLD ROCK AREA

(NTS 52F/SE)

Districts of Kenora and Rainy River

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MINISTRY OF NORTHERN DEVELOPMENT
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by
M.A. Boer

1980

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MAP
(accompanying report)

Map 5061 (coloured) – Northern Ontario Engineering Geology Terrain Study, Data Base Map, Gold Rock (NTS 52F/SE). Scale 1:100 000.

Northern Ontario
Engineering Geology Terrain Study 38

GOLD ROCK AREA

(NTS 52F/SE)

Districts of Kenora and Rainy River

by

M.A. Roed[1]

1.0 INTRODUCTION

This report and the accompanying map present the results of an engineering geology terrain study for the Gold Rock area, Districts of Kenora and Rainy River. The area, which covers NTS block 52F/SE, lies between Latitudes 49°00'N and 49°30'N and Longitudes 92°00'W and 93°00'W. The report and map form part of a series of publications which provide similar terrain data for approximately 370 000 km^2 of northern Ontario.

The purpose of this study is to provide an inventory of engineering geology terrain conditions that will serve as a basic data framework for engineering and resource planning activities, at a level of detail consistent with a scale of 1:100 000. The terrain information is contained on the Data Base Map (OGS Map 5061, accompanying this report).

Interpretation of 1969 and 1970 black and white aerial photographs, at a scale of approximately 1:50 000, formed the basis of the terrain mapping

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process. The interpretation was compared to relevant published information for the study area. In addition, the main roads in the area were traversed during the summer of 1978 to provide spot checks of the office studies. Thus, the Data Base Map represents a reconnaissance overview of the engineering conditions of the terrain.

An engineering terrain legend was developed to facilitate the mapping and to provide a common information base for the entire map series. This legend is shown on the accompanying Data Base Map. Further discussion on the mapping techniques, legend format, and possible uses of this engineering geology information is available in the Ontario Engineering Geology Terrain Study Users' Manual (Gartner, Mollard, and Roed 1980), a companion publication to this series of maps and reports.

2.0 GEOLOGIC SETTING

The Gold Rock area is underlain by crystalline bedrock of Precambrian age which is covered in places by a thin, discontinuous mantle of Quaternary surficial deposits. The terrain is dominated by bedrock landforms, but ground moraine is well represented. Glaciolacustrine and glaciofluvial deposits occur, and organic material is widespread. Alluvial deposits are poorly represented. The most distinctive feature is a complex moraine-like landform that trends northwesterly and transects the entire map-area.

2.1 BEDROCK GEOLOGY

The map-area, which lies within the Wabigoon Belt in the Superior Structural Province of the Canadian Shield, is underlain by two contrasting bedrock types, both of Early Precambrian age. The northern half of the area is dominated by a large belt of mafic to felsic metavolcanics which has associated with it several large felsic intrusive bodies and a central core of metasediments. A circular mafic intrusive body with a maximum diameter of 10 km lies immediately northeast of Entwine Lake in the southwest-central part of the map-area. The remainder of the area is underlain by undifferentiated felsic igneous and metamorphic rocks. Middle to Late Precambrian diabase dikes may occur in places (Davies and Pryslak 1967).

Areas of high mineral potential occur in several localities throughout the metavolcanic-metasedimentary belt: for gold around Lower and Upper Manitou Lakes, for gold-silver around Kawashegamuk Lake, and for iron around Bending Lake. Most of the remaining parts of the belt have medium potential. The mafic intrusive body has high potential for copper-nickel. The mineral potential of the felsic igenous and metamorphic rocks is rated as least (Springer 1978).

2.2 QUATERNARY GEOLOGY

Northwestern Ontario was affected by several stages of continental glaciation during the Pleistocene. However, only deposits of the last glaciation, the Laurentide of Wisconsinan age, are preserved in the Gold Rock area. The ice began to advance approximately 100 000 years ago and travelled as far south as central Wisconsin before receding. The ice disappeared from the Gold Rock area approximately 15 000 years ago (Prest 1970). Zoltai (1961) gives a more complete account of the glacial history of the region.

Widespread stagnation of the ice mass resulted in the deposition of a variety of surficial materials. Till was deposited directly by the ice in the form of ground moraine and hummocky moraine. Meltwater from the glacier formed glaciofluvial outwash deposits and kames, and was a major contribution to the formation of the moraine-like feature which cuts through the area. Ponded meltwater accumulated in lowlands to form glacial lakes. These lakes grew in size and eventually coalesced to form an enormous body of water called Glacial Lake Agassiz. Deposits of glaciolacustrine silt and clay occur in the lowlands adjacent to Kawashegmuk Lake. In some localities, bedrock hills were swept clean of unconsolidated material during high water stages of Glacial Lake Agassiz, as evidenced by numerous bare bedrock knobs. In the rocky uplands, the glacier overdeepened valleys, rounded off bedrock outcrops, and left scattered deposits of moraine and boulders. Glacial lake water did not inundate large parts of these rocky uplands.

The complete disappearance of glacial ice and gradual draining or drying up of glacial lakes marked the end of the Pleistocene Stage of the Quaternary Period in the area. Since that time, approximately 9 000 years ago (Prest 1970), modern streams have developed alluvial flood plains and organic deposits have accumulated in wet depressions. These deposits are

nonglacial in origin and, together with the various glacial materials, comprise the variety of Quaternary unconsolidated deposits that forms a discontinuous mantle over the bedrock in the Gold Rock area.

2.3 PHYSIOGRAPHY

With the exception of the ridged bedrock terrain near Bending Lake in the eastern part of the area and along the Trout River in the southwest-central part, the topography generally consists of rolling and knobby rock-buttressed landforms with numerous lakes and bogs. Elevations range from 371 m at Lower Manitou Lake to 457 m along the morainal ridge west of Pekagoning Lake in the southeastern part of the area. Distinct scarps occur in places, drumlinoid landforms are common in the northwestern part of the area, and low till ridges of minor extent are widespread. Potholes have been described by Blackburn (1976) along the shore of Upper Manitou Lake. Low-lying organic and other poorly drained terrain is particularly common in the southeast-central portion of the map-area. Alluvial terrain is restricted to a few poorly developed underfit streams.

3.0 ENGINEERING TERRAIN UNITS

Engineering terrain units are composed of a combination of various materials (unconsolidated and/or bedrock) which form recognizable landforms with certain engineering characteristics. Major terrain unit groups, and the engineering significance of each, are discussed in detail. These include bedrock terrain (RN, RR), moraine (MG, MH), and, to a lesser extent, glaciofluvial (GO, GK) and glaciolacustrine (LP) deposits. Organic terrain (OT) is common in all parts of the area, but alluvial plains (AP) are not well developed along streams. A diagrammatic sketch of a typical terrain setting is given in Figure 1. Table 1 summarizes the characteristics and engineering significance of the major terrain units in the Gold Rock area.

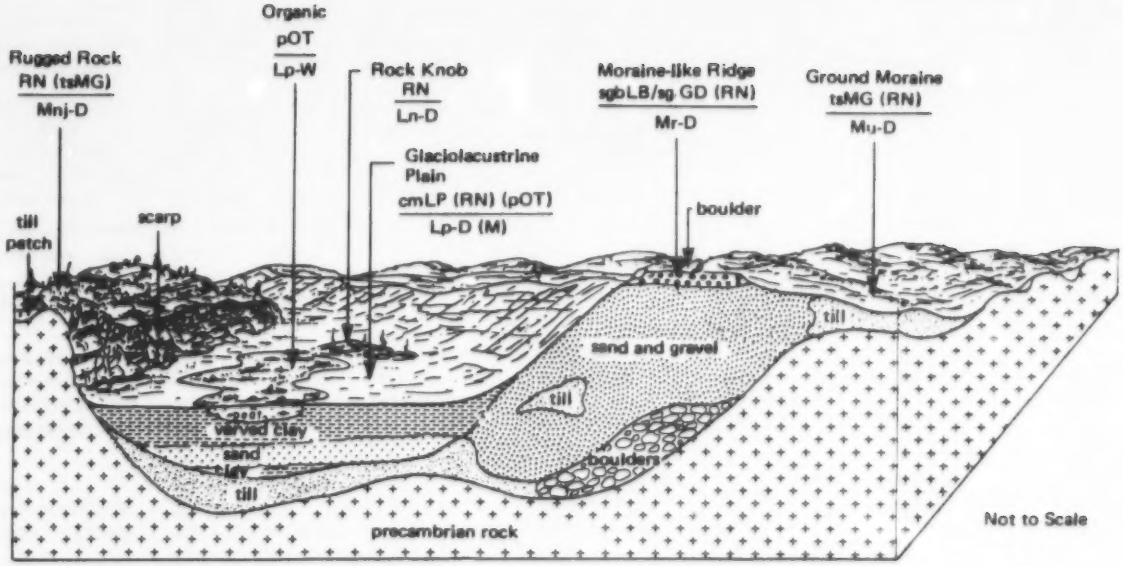

FIGURE 1 – DIAGRAMMATIC SKETCH SHOWING TYPICAL TERRAIN TYPES AND THEIR REPRESENTATIVE LETTER SYMBOLS.

TABLE 1 SUMMARY OF TERRAIN UNIT CHARACTERISTICS AND ENGINEERING SIGNIFICANCE, GOLD ROCK AREA

CLASSIFICATION		ENGINEERING USE				
Terrain Unit and Location	**Material; Relief; Topography; Drainage**	**General Construction**	**Transportation Routes**	**Waste Disposal**	**Groundwater Supply**	**Major Constraints**
BEDROCK TERRAIN (RN, RR), throughout map-area	rock; moderate relief (15 to 30 m); undulating to ridged; drainage good	excavations and fill necessary for most types	expensive excavations and fill required; aggregate in small pockets	unsuitable	deep wells provide enough water for domestic use	rugged terrain; lack of aggregate; expensive blasting required for roads
GROUND MORAINE (MG), south of Stormy Lake and along Manitou Road	sandy till mantling the bedrock; moderate relief (15 to 30 m); knobby; drainage good	excavation and fill necessary for some types of construction	excavation easier than in rock; aggregate in small pockets	suitable for septic systems where deposits are at least 1.5 m thick	poor to fair	deposits are thin; chance of rock; aggregate must be imported
HUMMOCKY MORAINE (MH), END MORAINE (ME), in a complex morainal ridge	sandy till; low relief (less than 15 m); knobby and ridged; drainage good	good	excellent	generally suitable	fair to good	rough topography; some rock; large boulders
GLACIOFLUVIAL ESKERS (GE), KAMES (GK), DELTA (GD), along a complex morainal ridge	sand, gravel, till; low relief (less than 15 m); knobby, ridged; drainage good	excellent	excellent	generally suitable	excellent	quality of aggregate
GLACIOFLUVIAL OUTWASH (GO), small pockets throughout area	sand and gravel; low relief; planar to undulating; drainage mixed	conditions good except where drainage is poor	fair to good; aggregate available	unsuitable	excellent	deposits may be small; water table high in places

GLACIOLACUSTRINE PLAIN (LP), scattered localities	clay, sand, and silt (csm); low relief; planar, drainage mixed	easy excavation	aggregate must be imported	generally suitable	poor	frost susceptible; poor drainage in places; low bearing capacity for large structures
ORGANIC TERRAIN (OT), in poorly drained depressions	peat (p); low relief; planar; wet	low bearing capacity; frost susceptible; high compressibility	unsuitable for subgrade except for light vehicle roads	unsuitable	poor	low strength; poor drainage; high frost susceptibility

Comments: Most alluvial plains (AP), except for the one shown along the Turtle River, are too small to map at this scale.

3.1 BEDROCK

Examples. $\frac{\text{RN(tsMG) (pOT)}}{\text{Mn-D(M)}}$ $\frac{\text{RR(tsMG)}}{\text{Mnr-D}}$

Almost all of the bedrock terrain (RN) is knobby (n) and of moderate relief (M). Scarps are particularly common in the areas underlain by folded metasediments, and parts of the unit are quite rugged (j). Ridged bedrock terrain (RR) occurs along the Trout River in the southwest-central part of the area and southeast of Stormy Lake in the eastern part. All bedrock terrain contains patches of discontinuous sandy bouldery till less than 1 m thick, but in places along the flanks of depressions the till may thicken to more than 3 m. Till ridges occur but are not common. Organic deposits are widespread in poorly drained localities. Varved clay occurs in association with the bedrock terrain, in the northern part of the map-area. This clay may also occur locally beneath organic material in other parts of the unit. Glaciofluvial sand and minor gravel deposits are common in the bedrock terrain of the northeastern part of the area, and may occur unpredictably elsewhere in the unit.

The main engineering significance of bedrock terrain is that it is difficult and expensive to excavate. Also, because of the rugged topographic character, extreme alignment techniques and deep cuts and fills are necessary for adequate road construction. In many places, this terrain unit has a limited supply of unconsolidated material and a shortage of available aggregate. Importation of suitable materials is often necessary and involves substantial expense. It has been observed, however, that thick blankets of ground moraine till do occur in association with some bedrock landforms, and pockets of glaciolacustrine silt and clay are particularly common in the southern part of the area. Careful exploration for these soil types could substantially decrease engineering difficulties in bedrock terrain. Local deposits of glaciofluvial sand and gravel are to be expected and some raised beach gravel deposits occur along rock-buttressed shorelines, but generally aggregate is scarce.

Groundwater occurs in fractures and along fault zones in the bedrock, but this terrain unit is considered to have only poor to fair potential for groundwater supplies. Bedrock terrain is unsuitable for surface waste disposal of any kind, except where there is a thick layer (at least 1.5) of attenuating soil material.

3.2 MORAINE

Examples. $\frac{\text{tsMG(RN)}}{\text{Mn-D}}$ $\frac{\text{tsMG(sgGE) (RN)}}{\text{Lnr-D}}$ $\frac{\text{tsMG(RN) (pOT)}}{\text{Mnj-D}}$

$\frac{\text{tsMH(sgGE) (RN)}}{\text{Lnr-D}}$ $\frac{\text{sgbME(RN) (sgGD)}}{\text{Mn-D}}$

Moraine in this area consists of a major complex moraine-like feature, ground moraine, hummocky moraine, and a major complex moraine-like feature.

A prominent northwesterly trending moraine-like ridge with a maximum elevation of 457 m divides the map-area. This feature is composed of sand, gravel in kames or eskers (GK or GE), till in the form of end moraine (tsME), deltaic sand and gravel (sgGD) or, in places, just till in hummocky moraine (tsMH). It is defined in some localities by an esker-like or ridges (r) landform, and in others it takes the form of a relatively wide, rounded ridge. In at least one locality, large boulders are abundant in moraine adjacent to this ridged feature. In this map-area, the ridge does not appear to have been modified by glacial lake action, except possibly west of Pekagoning Lake. It appears to be mainly an ice-contact or dead-ice type of landform in the Gold Rock area.

Ground moraine (MG) composed of sandy bouldery till (ts) occurs in association with rock knobs (RN) around Kawawia and Kenozhe Lakes in the western part of the area and over a large expanse of ground extending from Wapageisi Lake south to the Turtle River. Till ridges are common in this unit, relief is moderate (M), and the terrain is generally dry (D).

Hummocky moraine (MH) occurs as part of the moraine-like feature at Thundercloud Lake in the northern part of the area, in the vicinity of Crooked River on the northern margin, and to the northwest of Islets Lake in the east-central part. Sandy, very bouldery till is the most common material, but pockets and lenses of sand or gravel may occur. Linear till or gravel ridges also characterize the unit in places. Subordinate landforms include bedrock knobs, glaciolacustrine clay plains, and organic terrain.

All moraine in the map-area is well drained (D), except for organic-rich depressions which are usually wet (W).

The engineering significance of the moraine-like ridge is substantial, especially in view of the extent of this feature. It is the only large deposit of well-drained surficial aggregate in the entire map-area. Although sand-sized material dominates in the unit, extensive gravel lenses are present. The flat or gently undulating, well-drained surface of the moraine, combined with the excellent foundation characteristics of the materials, provides an optimum site for construction of foundations, runways, roads, and other structures. However, care should be exercised to ensure that construction on this feature does not prevent the future utilization of all good quality aggregate supplies at any particular site.

The water table is generaly very low within the unit, but where a sufficient portion of the material lies below the water table, it could form a very important groundwater aquifer. Because of its groundwater potential and its porous nature, the unit is generally not suitable for waste disposal apart from widely spaced septic drain tile fields.

Ground moraine and hummocky moraine in this area are well drained. They provide excellent sources of well-graded fill and are usually suitable for waste disposal. Groundwater potential is considered fair where the deposits lie below the water table.

3.3 GLACIOFLUVIAL

Examples: $\frac{\text{sgGO(pOT) (RN)}}{\text{Ludp-D(M)}}$ $\frac{\text{sgGK(ME)}}{\text{Mr-D}}$

Glaciofluvial terrain is difficult to recognize in the Gold Rock area, but a number of small outwash plains have been outlined, particularly in the south-central part. Most of the deposits are composed of gravelly sand (sgGO) and they are usually associated with bedrock (RN) and organic terrain (pOT). Some of the glaciofluvial units that occur in low-lying depressions may be wet, but most are dry. The prominent moraine-like feature includes kames (GK) and eskers (GE) along its extent. Some outwash deposits such as those along the Turtle River in the central part of the area and near Rutter Creek and around Grey Trout Lake in the southeast corner, are related to this feature.

Varved clay overlies at least 10 m of glaciofluvial sand and gravel in a pronounced valley at the western end of Snake Bay (Stormy Lake) in the north-central part of the area. Similar subsurface occurrences may be present in other parts of the area.

The Turtle River-Bending Lake topographic depression in the eastern part of the area may have been a meltwater channel or spillway. If so, it may contain sand and gravel deposits additional to those delineated to the north of Pekagoning Lake.

Glaciofluvial deposits are potential sources of substantial quantities of surficial aggregate. The unit also provides good foundation conditions where drainage is adequate, and is considered a good potential groundwater aquifer. It is unsuitable for waste disposal, except for widely separated septic drain tile fields.

Sand and gravel for road building can be obtained from eskers (GE), kames (GK), and other glaciofluvial (GO) units. Very thick and extensive gravelly sand is suspected to occur in the moraine-like feature (1) south of Turtle River in the southeastern part of the area, and (2) Walmsley Lake near the northern boundary. Some excellent aggregate deposits presently being utilized could not be accurately delineated on the air-photos. An example of this is a gravel pit in an esker or kame deposit located 5 km west of the settlement of Gold Rock in the northern part of the area. Detailed photogeology and ground checking is necessary to locate this type of deposit. Many features mapped as minor till ridges may contain gravel and, as noted above, deposits beneath clay along valleys may be more abundant than indicated on the map.

3.4 GLACIOLACUSTRINE

Examples: $\frac{\text{cmLP(tsMG) (RN)}}{\text{Lpn-D}}$ $\frac{\text{sLP}}{\text{Lp-D}}$ $\frac{\text{csLP/gsGO(sGO)}}{\text{Lpu-D}}$

Red and grey varved clay (cm) of glaciolacustrine origin (LP) is common along the lowlands bordering Kawashegamuk River and Walmsley Creek. The deposits form well-drained (D), undulating plains of low relief (Lup) amidst bedrock knobs (RN). The bedrock (RN) and hummocky moraine (MH) units in the northern part of the map-area also contain widespread but patchy occurrences of glaciolacustrine varved clay. Most of the organic deposits in the south-central part of the area are underlain by

glaciolacustrine clay. However, much of the terrain does not appear to have been inundated by glacial lake waters. Mapped limits of the glaciolacustrine terrain are highly speculative and are intended as a general indication at best.

The glaciolacustrine silt and clay plains are ideally suited for the excavation involved in engineering projects such as pipeline and transportation routes. The material is easy to handle and is dry in many places, although wet conditions do exist locally. It tends to settle, which makes it a poor fill material, and generally is highly frost susceptible, which reduces its suitability for foundations. Bank stability in the glaciolacustrine unit is a potential problem along the steep slopes of river banks and along shorelines subject to wave action.

Interbedded sand layers may occur at depth and would form potential groundwater aquifers, but generally the unit is a poor source of groundwater. The upper part of the clay is fractured, and dug wells in this unit may supply water in some locations. Glaciolacustrine terrain is generally suitable for waste disposal and septic drain tile field installation. Sanitary landfill operations will experience difficult working conditions during winter months when the sediments are frozen.

3.5 ALLUVIAL

Examples: $\frac{spAP}{Lp\text{-}M}$ $\frac{pAP}{Lp\text{-}W}$

Alluvium consisting of sand, silt and peat occurs along the flood plains of some stream channels. The best example in the Gold Rock area is the flood plain of the Little Turtle River. Other streams have poorly developed channels, and deposits consist mainly of peat and silt. The terrain is generally poorly drained.

Alluvial terrain may be subject to flooding. Due to the predominance of fine-grained and organic materials, it is a very poor foundation material. Construction is difficult and expensive in organic terrain due to the poor drainage and the low strength, low bearing capacity, high compressibility, and extremely high frost susceptibility of the soil materials. Groundwater potential is low and water quality is poor. Alluvial terrain is not suitable for waste disposal.

3.6 ORGANIC

Examples: $\frac{\text{pOT}}{\text{Lp-D}}$ $\frac{\text{pOT/cmLP}}{\text{Lp-M}}$

Organic terrain composed of peat (pOT) in poorly drained (M) depressions is common. Many organic deposits are underlain by varved clay (pOT/cmLP). Organic terrain is poorly drained (W), but some deposits appear to be dry during parts of the year (M).

Construction is difficult and expensive in organic terrain due to the poor drainage conditions and the low strength, low bearing capacity, high compressibility, and extremely high frost susceptibility of the soil materials. The unit is generally poor for engineering or construction use, but light vehicle roads are buit with some success across some of the dryer deposits. Groundwater potential is low and the terrain is not suitable for waste disposal.

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